

VI.

ON SOME IRISH MALDANIDAE.

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PLATES XVII-XIX.

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IN 1909 I received, through Mr. R. Southern, of Dublin, a small collection of Irish Maldanidae, belonging to the Irish National Museum, for description. The collection contained only a few determinable species—those which are hereafter discussed. Amongst these are two which, though not quite unknown before, have not been previously described. In addition, the collection contains *Praxillura* sp., from the south coast of Ireland (Station R. 30; 8, p. 127); *Petaloproctus* sp., from the west coast (W. 115; 10, p. 170); a species which is possibly near akin to *Isocirrus*, from the same locality as *Praxillura*; *Leiochone* sp. [*clypeata*?], from the west coast (W. 115; 10, p. 170, and L. 296-L. 300; 6, p. 41) and the east coast (S. 166; 6, p. 69); *Leiochone* sp. [*cirrata-borealis*-group], from the south-west coast (S. R. 172; 6, p. 84, and S. R. 590; 9, p. 156); *Praxillella* sp. [*gracilis*-group; cf. 5, p. 190], from the the south-west coast (S. R. 16; 10, p. 165); *Euclymene* sp. [a large species], from the south coast (R. 30 and R. 31; 8, p. 127); and in addition to these, at least four species, all belonging to the Tribus Euclymenini (R. 31; 8, p. 127; S. R. 5; 6, p. 64; S. 273; 7, p. 102; Kingstown-Dalkey, 14.6-22m. [20/7, 1907]).

***Nicomache (Nicomache) maculata* n. sp.**

(Plate XVIII., figs. 13-19; Plate XIX., figs. 27-30.)

"*Nicomache lumbricalis* (Fabricius)," Cunningham and Ramage (1, p. 678, fig. 41), and Michaelsen (4, p. 39); cf. 5, pp. 99 and 95.

Specific Diagnosis.—The anterior part more or less distinctly speckled; especially conspicuous is one rounded spot outside each nuchal organ, and one or more transverse bands of colour on the back of the fore-part. Ocelli are present. Twenty-two setigerous segments and one (as a rule quite) achaetous posterior segment. The cup-shaped section at the hindmost extremity is short, and but little longer on the ventral side than on the back. The anal cirri are not characterized by different sizes. Nephridia in setigerous segments 6-9. The front part of the body is not particularly strong in glands—at any rate not the hinder part of the segments in this region; on the hinder segments

distinct glandular bands on the back between the parapodia, which bands more and more completely encircle the body towards the hinder part, and also on the posterior achaetous segment. Straight spines on the three foremost setigerous segments. Uncini of the setigerous segments 4-5 (- 6) considerably reduced, and without or with only very weak hair. The fully developed uncini, whose inner and under contour is not bent out, have some hairs and up to seven teeth. The anterior capillary setae have from the very first setigerous segment weak side-teeth, which towards the hinder part increase somewhat in strength. The long under setae, which have only traces of side-teeth, exist (in individuals which are not, or in any case not fully, sexually developed) from one to three in number on the fourth to the twenty-second setigerous segments. The posterior capillary setae chiefly with rather broad borders—which on the whole, however, grow smaller towards the rear—and not particularly long points. Tubes rather thin, and somewhat flattened and closed up.

Colour.—The anterior part as far as the third setigerous segment is more or less strongly speckled with brown, but further behind the spots decrease rapidly; and moreover, the same segments on the ventral side, at least towards the posterior region, are speckled extremely little or not at all. The more or less varied distribution of the spots is shown in figs. 13-15. Especially conspicuous are the transverse bands and the strongly marked spot outside each nuchal organ. In a very light-coloured individual from Blacksod Bay there are only these last-named two spots, and a band of colour on the posterior part of the head. Another individual from the same locality has the anterior part of the head very light-coloured. Here are found the two spots on the side, but else only one in the middle of the anterior part; this latter can be distinguished as a rule in the more strongly coloured individuals.

Cunningham and Ramage (1) write as follows concerning this species, which they have obviously seen:—"The dorsal surface of the first few somites is abundantly spotted with red and white." (Pl. 47, fig. 41.)

External Structure.—As in my earlier descriptions of *Nicomache*-species (5), which are of course very much like one another in many cases, I can express myself very briefly as regards the external structure of the body. Rather few ocelli are found on either side of the front upper part of the head, and they are seen best on the more faintly coloured individuals (fig. 15). The nuchal organs, which can be clearly seen in fig. 13 (here drawn in a somewhat different way from that adopted in my earlier figures), are rather long and distinctly bent.

The seven complete individuals observed have all 22 setigerous segments and one posterior achaetous segment. Of the 15 other posterior portions observed, 11 are normally developed, while the remaining 4 have capillary

setae on either side of the hindmost segment, which is usually free from setae (fig. 16). On three individuals capillary setae are developed on the left-hand side, and on one on the right-hand side; one of the first set comes from Blacksod Bay, while all the rest are from Howth.

The cup-shaped section at the hindmost extremity is rather short, and but little longer on the ventral than on the dorsal side (fig. 16). The majority, at least, of the anal cirri are like fingers, and are of approximately the same length; but they appear to be somewhat shorter towards the dorsal side. Besides these, however, there occur, except in the case of the largest individuals (fig. 18), one or more smaller cirri between the larger ones. Of these smaller cirri those are particularly noticeable which are almost always found developed upon both sides or upon only one side of the ventral nerve-cord; often these are merely indicated by a little fold; in the individual represented in fig. 18, even these are absent. The numbers of cirri found in all the individuals investigated are set forth in the following table:—

Nos. 1-8 (all small ones) are from Blacksod Bay, the others are from Howth.

No.	Number of cirri, with the exception of the smaller ones near the ventral nerve-cord.		Number of cirri adjacent to the ventral nerve-cord.
	(a) Medium size.	(b) Distinctly small ones are among the larger.	
1.	18	1	2
2.	20	traces of 1	traces of 2
3.	16	traces of 1	2 (very small)
4.	18	2	traces of 1
5.	17	1	traces of 2
6.	16 ¹	—	1
7.	17 ¹	—	2 (very small)
8.	18 ¹	—	traces of 1
9.	19	—	2 distinct ones
10.	18	2 of medium length	1 of medium length to the left
11.	16	1 (small)	2 (one being quite short)
12.	19	—	2 rather long ones
13.	e. 19	—	1
14.	17	—	—
15.	18	—	1 (short)
16.	17	2 (small)	1 (short)

¹ In these three individuals, in particular, the highest cirri are small on the whole.

The area within the cirri does not appear to lie very deep, and is, moreover, only slightly oblique. Nephridia occur in the sixth to the ninth setigerous segments.

*Epidermal Glands.*¹—The anterior part as far as the fourth setigerous segment is plentifully furnished with glands (fig. 19). Especially noticeable are the rings in front of the parapodia,² and the glandular spots on the under-side of the first setigerous segment, which occur as usual in a long-extending form, but are here (because of some other system of preservation?) faint, and a well-marked protracted glandular spot immediately within each nuchal organ, and a smaller spot outside the foremost part of the same organ (fig. 17). On the fourth to the seventh setigerous segments chiefly are to be found anterior glandular rings, which, however, decrease in strength backwards. On the ventral side of the fifth to the eighth setigerous segments, immediately beneath and in front of the lowest uncini, are to be found small and highly characteristic round bundles of glands most distinctly on the sixth setigerous segment (fig. 19). On the eighth and following setigerous segments, the glands round the parapodia, and especially between those on the dorsal side, are weak. Towards the posterior parts these glands increase, and gradually (distinctly from about the twelfth setigerous segment) there appears a distinct glandular ring in the hindmost part of the segment. It increases backwards, and is found even on the hindmost segment, which is usually free from setae (fig. 16). The outer side of the posterior cup-shaped section is to some extent furnished with glands, especially towards the posterior parts, while the inner side is only slightly provided with glands. Finally, such are entirely lacking on the cirri and on the area within the cirri.

Setae.—The spines on the foremost three setigerous segments are straight and rather coarse (fig. 27). As a rule, they occur singly in each parapodium; but double ones have sometimes been observed on either side of the second and third setigerous segments.

On the fourth setigerous segment begin the uncini, which here and on the adjoining segments are moderately open (fig. 28). The number of uncini on the fourth to the twentieth setigerous segments of a large individual from Howth, which has received special investigation in the matter of setae, is as follows: 4, 5, 7, 8, 12, 13, 16, 15, 14, 13, 12, 10, 12, 12, 12, 13, 14. On another large individual the nineteenth to the twenty-second setigerous segments have the following number of uncini: 15, 15, 16, 16. The number of teeth

¹ All observations about epidermal glands refer exclusively to such as have been coloured with iodine green; cf. Arwidsson (5).

² In a number of individuals, probably those preserved in some other way, it is precisely the glands on the posterior part of these segments that are most conspicuous, particularly on the under side.

in fully grown individuals¹ is $2-3^{4-5}$, $(3-)^4$, $5-6^{7-10}$, 6^{11-19} , $5-6^{20-22}$; a seventh tooth can be traced on the fourteenth segment and perhaps on the adjoining segments.

On the fourth and fifth setigerous segments the upper uncini at least lack bristles; and accordingly it is not till the fourth seta reckoned from above, that bristles appear on these segments in the large individual investigated. On the seventh setigerous segment no uncinus lacks bristles, but even on the sixth setigerous segment the two or three uppermost uncini lack bristles, or have only very feeble ones.

The fully developed uncini (fig. 29) have their lower contour perfectly even.

The points of the anterior capillary setae have, even so early as the first to the third setigerous segments, distinct though slight side-teeth; and these afterwards increase somewhat, although they never perhaps become quite as large as in *Nicomache minor* Arwidsson, whose setae they greatly resemble. The long capillary setae underneath, which may be found in the fourth to the twenty-second setigerous segments, have all but imperceptible traces of side-teeth; but so much of them one can see that one can determine that they stand somewhat more closely towards the outer point of the setae. On the fourth setigerous segment, for instance, two such setae have been observed, and on the sixth and seventh setigerous segments three, one in each case being particularly long. The posterior capillary setae have, on the three foremost setigerous segments, rather broad borders, often of the same size on each side; towards the posterior regions one border at least may diminish quite distinctly, but, as fig. 30 shows, there may be found here also two rather broad borders of equal size. The points of these setae do not appear to be particularly long: in any case such have not been observable in the material at the disposal of the writer. As usual, the points are shortest on the foremost segments.

Size.—The largest individual from Howth attains a length of 45 mm., as compared with a breadth of 1.2 mm. The largest individuals from Blacksod Bay are considerably smaller.

Sexual Maturity.—The large individual just mentioned is a ♂, taken 6th October, 1909, and then at least near sexual maturity.

Tubes.—Tubes observed from Blacksod Bay are formed chiefly of small, light-coloured grains of sand, amongst which may sometimes occur the shells of small mussels. These are—partly at least—closed up, somewhat winding, somewhat flattened tubes, and are provided with grains of sand all the way round. The outer diameter of a measured tube is 2.6 mm. as compared with an inner diameter of 1.0 mm.

¹ For the system of notation used see my earlier treatise (5).

Notices of Finds.—Stella Maris Bay, Howth, East Ireland, at least 10 individuals, of which 3 are perfect. Feorinyeeo Bay, Blacksod Bay, Station No. W. 116 (10, p. 170), West Ireland, at least 11 individuals, of which 4 are complete.

Information about Earlier Finds.—Evidently Cunningham and Ramage (1) have taken this species in the Firth of Forth. They write as follows about it: "Commonly found among Laminarian roots, also occasionally under stones" (see also 5, p. 99). But also the new species which I formerly (5, p. 95) thought I could establish from Heligoland in accordance with Michaelsen's description (4, p. 39) is plainly identical with *Nicomache maculata*.

Regeneration.—Howth: 1 anterior setigerous segment: 2; 2 anterior ditto: 1; and 1 posterior ditto: 1 individual. Blacksod Bay: 1 anterior setigerous segment: 2; 8 posterior ditto: 1 individual.

Leiochone sp.

From Galway Bay, in the West of Ireland, or, more precisely, Station A. 124 (7, p. 94), or S.W. of 2nd buoy of Margaretta Shoal, 18 m., comes an individual, small, complete, but regenerated in both its anterior and its posterior regions, which, so far as one can gather from the investigation of such scanty material, approximates very closely to *Leiochone polaris* (Théel) (5, p. 150). The purely Arctic distribution of the latter species, however, which is not known even from the most northerly parts of Norway (5, p. 155), renders it improbable that the present species is identical with the one mentioned. The investigation of fuller material is the necessary preliminary to settling this question.

The individual in question, like *L. polaris*, possesses 19 setigerous segments and probably 3 hinder achaetous segments. At any rate, two of the last-named can distinctly be observed, and behind these there is room for one more. The ventral anal cirrus is distinctly developed. The regenerated anterior region embraces 3 setigerous segments and is 2.4 mm. long; the fourth to the eighth setigerous segments are normally developed and measure 4.5 mm.; the regenerated posterior region measures 4 mm. in length. No ocelli can be discerned, which of course does not preclude the possibility of their being found in the fully developed head. The epidermal glands, on the whole, resemble those in *L. polaris* (5). The following divergences, however, have been noticed. The stronger glands forwards on the fourth to the sixth setigerous segments diminish more rapidly behind the parapodia, whereas the more faintly coloured ones (cf. 5) in the hinder part of the segments are quite close together, especially on the fourth setigerous segment, in the hinder part of which they form a distinct band; the seventh setigerous segment, on the other

hand, is quite free from glands at the back. The two obliquely extended spots of glands on the front upper part of the eighth setigerous segment (5, fig. 118) are here very straight, which may of course be connected with the fact that, in the individual in question, this segment is much extended and also of more even breadth, only tapering off somewhat in the very front part. The number of uncini on the 19 setigerous segments, of which, however, only the fourth to the eighth are fully developed to the normal extent, is as follows: 1, 2, 2, 4, 4, 4, 3, 3, 2, 2, 2, 2, 2, 2, 2, 2, 2, 1-2.

In connexion with this *Leiochone* species it may be mentioned that one individual of the *Leiochone* species earlier cited, which is near akin to or is identical with *L. clypeata* Saint-Joseph, possesses a fully projecting proboscis, a thing which I for my part have never before had the opportunity of observing in any species of this genus. This completely visible proboscis now shows that the papilliferous part is developed all round, although it is shorter forwards, it is true; Saint-Joseph (3, p. 140), speaking of *L. clypeata*, says: "une trompe globuleuse très vasculaire." In an earlier paper (5, p. 143), chiefly with regard to the conditions prevailing in *L. borealis* (p. 157)—in which, however, as mentioned, I have never had occasion to notice a completely projected proboscis—I have conceived the papilliferous part of the proboscis as almost vanishing in front of the mouth within the limits of the tribus *Leiochonini*: this conception, therefore, needs a certain amount of modification. Possibly in respect of proboscis-structure, as in several other respects, the various *Leiochone* species are essentially dissimilar.

Praxillella affinis (Sars) Arwidsson.

Of this species—formerly known only from Scandinavia (Kattegat and the Bergen region)—there are two mutilated individuals from the south coast of Ireland, or, more precisely, Station R. 31 (8, p. 127), or 6 miles S.E.S. of Mine Head, 53 m. Of one individual there remain the third to the eighth setigerous segments, of the other the third to the seventeenth. Besides these there is a posterior extremity, possibly belonging to one of the foregoing. All the parts correspond very exactly with Scandinavian individuals (5). Amongst other things are found the specially developed capillary setae on the tenth and the eleventh setigerous segments.

Genus *Caesicirrus* n. gen.

Generic Diagnosis.—Nuchal organ of medium length. Distinct head borders. The papillae of the proboscis are low or altogether absent. Segment with collar is absent. The parapodia of the eighth setigerous segment in the hinder part of the segment. There are distinct posterior achaetous

segments, and behind these a callus-shaped ring and at the hindmost extremity a cup-shaped section. The ventral cirrus, which is the longest, and the longer cirri, which are symmetrically arranged among the other anal cirri, have undivided tips; the shorter intermediate cirri have a lobate point. The anal cone, the anal papilla of which is drawn out like a finger, is low and lies in the bottom of a funnel-like depression. The cephalic plate has distinct glands, and the anterior segments distinct glandular bands. The uncini of the first to the third setigerous segments are not particularly strong, and lack bristles, and are, moreover, more or less transformed and usually stand singly in each parapodium; the neck of the fully developed uncini is inwardly distinctly constricted; the bristles join together under the big tooth. The anterior capillary setae have borders that are either faint or vanishing and a distinctly marked pencil of bristles. The posterior capillary setae have quite narrow borders and smooth points. Tubes free, straight, and rather thin.

Cunningham and Ramage (1, p. 679) figure, under the name of *Axiothea catenata*, a species which has not hitherto been at all well known. In an earlier treatise (5, p. 220) I have considered the possibility that the authors named have, in figuring the species in question, left out a segmental limit somewhere just before the parapodia of the eighth setigerous segment, and have thus found a certain resemblance to the *Euclymene droebachiensis* (Sars) described in detail by me. In the Irish collection now under consideration, however, I have certainly rediscovered Cunningham and Ramage's species, which exhibits such very remarkable phenomena that I will not increase the indefiniteness of the genus *Euclymene* Verrill by attributing the above species to this genus, which is assuredly very indefinite in its range, but must for this species establish the above-named new genus *Caesicirrus*. This new genus, however, is quite certainly nearly related to *Euclymene*: in other words, my diagnosis of Tribus *Euclymenini* must be widened so as to include forms with a long eighth setigerous segment, having parapodia situated in its hinder part. When I tried to define the Tribus named, no such form was known; in this connexion may be compared the species which I mentioned, but did not name (5, p. 243), from East Greenland, which species seems to lack a limit between the seventh and the eighth setigerous segment. That species also, as I then took occasion to observe, falls outside the Tribus *Euclymenini* as then defined by me, though it stands very near it of course. Perhaps it may be closely related to the species now under discussion, since its eighth setigerous segment seems to have more in common with the posterior long segments than with the anterior short ones.

The most distinctive characters of the genus *Caesicirrus* are plainly the

appearance of the eighth setigerous segment, the division of the anal cirri into long undivided ones, and short ones lobate at the point, and the prolonged anal papilla.

The nephridial pore is somewhat under the rows of uncini, and in a line with or slightly in front of these. The neck of the developed uncini is a little striated in an oblique fashion.

***Caesicirrus neglectus* n. sp.**

(Plate XVII., figs. 1–9; Plate XVIII., figs. 10–12; Plate XIX., figs. 20–26.)

“*Axiotea catenata* Malmgren,” Cunningham and Ramage (1, p. 679, fig. 42).

Specific Diagnosis.—The anterior point of the head rather short. The borders of the head are low, almost with faintly indicated lateral notches; the hinder notch between the borders is also faint. Ocelli numerous, in front of the mouth. The parapodia of the seventh setigerous segment situated somewhat in front of the posterior third. Nineteen setigerous segments and three posterior achaetous segments. Of long anal cirri there are three pairs, besides the ventral cirrus; the short anal cirri are found in each interval to the number of from one to four. Nephridia in setigerous segments 7–9. Anterior glandular bands are found on the first seven setigerous segments; on the fourth setigerous segment this band occupies the half of the section behind the parapodia; the posterior portion of the seventh setigerous segment is completely, though somewhat sparsely, covered with glands on its upper portion. The second setigerous segment has, on the whole, glands very much scattered, chiefly in the front of the parapodia; and the third is thinly covered with glands, for the most part all over it. The eighth setigerous segment possesses a somewhat distinct glandular band between the middle and the parapodia. From the middle of the seventh setigerous segment the glandular bands follow the ventral nerve-cord, being most strongly marked on the ninth to the fourteenth setigerous segments. More or less faint longitudinal glandular bands are found to the front and to the back of the uppermost uncini in the direction of the neighbouring capillary setae from the eighth to the twelfth (or thirteenth) setigerous segments inclusive (especially in the larger individuals). The uncini on the first three setigerous segments have a rather long inner section, and three or four teeth. The fully developed uncini have six teeth as a maximum. The anterior capillary setae are especially numerous on the eighth and the ninth setigerous segments; in a great many of the posterior capillary setae on the middle and posterior segments the bases of the points are more or less distinctly enlarged.

Colour.—As I have seen no living individuals, the accounts of Cunningham and Ramage (cf. 1) may appropriately be repeated here: “Colour pinkish, paler

towards the anterior end, with broad bands of deep-red surrounding the body at intervals (pl. 47, fig. 42)."

External Structure.—The forward point of the head is rather short and at the base but little removed from the cephalic plate (fig. 5). The borders are low, on the whole (fig. 7), though most distinctly so on the sides of the head; towards the hinder regions they diminish somewhat in strength and meet here in a fairly definite angle, when the cephalic plate is more or less extended. A lateral notch on each border can be seen at any rate on individuals with strongly compressed cephalic plates.

Numerous ocelli (fig. 4; cf. 1, fig. 42A) are to be found in front of the mouth in a rather broad band, which extends some distance up, on the under-side of the anterior point of the head, and which divides into two bands, as it were, at one place in either side, fusing again near the median line. The ocelli are distinctly reddish-brown, although the colour is fainter in youngish individuals; and similarly the number of ocelli in these individuals is not so large as in older ones, especially towards the middle. The proboscis could not be closely investigated in the material at my disposal. This much, however, can be said about it, viz. that it is perfect all round and has no extended papillae. Moreover, no papillae whatever could be observed on the faint ridges that run along the outer side of the proboscis—ridges which to the number of 24 are to be seen in fig. 1. The nuchal organs are not especially long and are separated by a rather broad but low keel (figs. 5 and 7).

The front edge of the first setigerous segment is slightly bent forwards in front of the parapodia. The length of the anterior setigerous segments diminishes pretty evenly as far as the fifth setigerous segment, after which the sixth and the seventh segments show a slight increase. On the last-named the parapodia are situated somewhat in front of the posterior third. The eighth setigerous segment is considerably longer than the one immediately before it, and its parapodia, like those in the segments that follow, lie far to the rear. These segments, to begin with, increase in length backwards; and the fifteenth and the sixteenth setigerous segments, in particular, are very long, the sixteenth being the longest. The hindmost setigerous segments diminish rapidly in length; there are 19 setigerous segments in all. After them there follow—very rapidly decreasing in length—3 achaetous segments (figs. 8 and 9), of which the last in particular is very short, with slight remains of parapodia. The foremost of these segments at least has a distinct posterior limit (fig. 8). Thereafter follows a callus-shaped ring which in certain positions is markedly defined towards the rear (figs. 8 and 9); in individuals that are not contracted at the commencement of the section that thereafter follows, which is rather short and cup-shaped, the ring in

question is not very sharply defined. The anal cone is low and barely perceptible; the anus is surrounded by several wrinkles, which, towards the anal opening itself (which is obviously not completely closed in fig. 8), has faint, slightly pointed elevations; the ventral anal papilla proper is prolonged finger-fashion. In fig. 12, where the intestine is shown in a somewhat projected position, these formations can be seen excellently. Whether the ventral nerve-cord can be seen between the large ventral anal cirrus (on the edge of the cavity) and the anal papilla cannot be determined, because of the smallness of the posterior ends at my disposal.

The anal cirri (on the edge of the cavity, cf. figs. 8–12) consist not only of the large ventral one, which is somewhat longer than half the diameter of the posterior funnel-like cavity, but also of three pairs of long ones and of short ones interposed among these. The longer ones, which are equal to half or more than half of the large ventral cirrus, taper, like this last, pretty evenly towards the slightly rounded point. The position of the three pairs mentioned is displayed in the figures. The small intermediate short cirri have distally short finger-like lobes, which vary slightly in number and position. If the seven intervals between the long cirri, beginning from that which lies nearest to the left of the ventral cirrus, are numbered continuously from 1 to 7, the following table shows at a glance the number of the short cirri in the six individuals investigated (the individuals depicted in figs. 12 and 10 being Nos. 1 and 2 respectively). The individuals are as far as possible arranged in order of magnitude, beginning with the larger ones:—

No. 1 ¹ ,	3, 2, 2, 3, 4 ² , 2, 2, cirri
„ 2,	3, 1, 4, 2, 4, 3, 3, „
„ 3,	2, 3, 4, 2, 2, 2, 3, „
„ 4 ¹ ,	3, 2, 3, 4, 3, 2, 3, „
„ 5 ¹ ,	2, 1, 1, 1, 2, 1, 1, „
„ 6 ¹ ,	3, 2, 0, 2, 1, 1, 4 ² , „

If in the last-named individual, or No. 6, the small lobate cirri are taken one after another, beginning to the left of the large ventral cirrus, they have the following number of lobes: 3, 2, 1; 4³, 2; 3, 2, 3; 4⁴, 2, 4, 1⁵; 4, 2⁶, 3; 2⁶, 3; 2⁶, 2, 3.

The three complete individuals at my disposal have all the same number of

¹ The posterior part is regenerated, though on the whole fairly perfect; this is especially the case with No. 1.

² The middle ones are not completely separated; in No. 6, moreover, they are of somewhat unequal length.

³ First divided into two, with 3 and 1 lobes.

⁴ Broad, divided into two, at first; lobes?

⁵ Narrow.

⁶ Rather deeply divided.

setigerous segments, and of posterior achaetous segments; and three other individuals investigated exhibit the same structure of the hind part as the first-named.

Nephridia are found in the seventh to the ninth setigerous segments, cf. fig. 3, which show the orifices on the ninth setigerous segment, whereas on the other segments these do not here appear, but there can be seen beneath the uncini a little field free from glands, which surrounds each orifice. The number of the nephridia has been determined by dissection.

Epidermal Glands.—The cephalic plate (fig. 5) possesses distinct glands, which are strongest on the anterior point and on the outer ends of the nuchal organs. The anterior region is thinly covered with glands as far as somewhat behind the parapodia of the first setigerous segment (figs. 1, 2, 5). The ventral nerve-cord, however, under the parapodia of the same segment is free (fig. 1). Towards the rear there are, on the whole, only some very few glands on the sides at about the middle of the segment (fig. 2). The second to the seventh setigerous segments, but the second to the fourth in particular, possess a free edge anteriorly; the second setigerous segment has, in front of the parapodia, a band of sparse but large glands (figs. 1 and 2). Behind these there is a number of very scattered glands straight behind the parapodia, some on the ventral side and very few on the dorsal side anteriorly. The hindmost part of the segment is free, or, in the larger individuals, it has glands to a faint and scanty extent all through; the same is the case with the preceding segment. The third setigerous segment, like the preceding one, has sparse glands in front of the parapodia, but also over nearly the whole segment (fig. 2), most thickly (in the smaller specimens) in a streak straight behind the seta. The fourth to the seventh setigerous segments have—with the exception of the free interior edges just mentioned, which moreover diminish backwards—close-packed glands in front of the parapodia. On the fourth setigerous segment, moreover, these extend almost as far behind the parapodia as to the front of them, but with some indication of a break on the dorsal side behind the parapodia; on the two following segments the glandular band diminishes behind the parapodia, so that, especially on the last segment, it scarcely surrounds the parapodia, and at the same time the break mentioned on the dorsal side becomes more distinct. On the ventral nerve-cord, however, there remains a number of glands, even further back; and on the sixth setigerous segment these join a faintly marked glandular ring round the hinder part of the segment (fig. 2). On the hindmost parts of the fifth to the seventh setigerous segments there are also, especially on the upper side, a number of very thinly distributed glands. The seventh setigerous segment is thickly studded with glands in front of the parapodia, with the exception,

however, in a number of individuals, of the region round the orifices of the nephridia (as always on the eighth setigerous segment, fig. 3). The hinder part of the segment is free underneath, with the exception of sparse glands on the ventral nerve-cord, but the upper side is covered pretty evenly with rather dense glands (fig. 6). Straight behind the topmost part of the row of uncini these glands are somewhat more powerful; and this string of glands continues into the eighth setigerous segment, which otherwise in its anterior part possesses only some scattered glands in the middle of the dorsal side, faintly marked ones along the ventral nerve-cord, and a number of scattered ones in the neighbourhood of this last. From the middle and to the setae the same segment is surrounded by a ring of pretty dense glands, which, however, are rather faintly marked in comparison with the glandular rings of the preceding segments. In front of the upper uncini there are a number of glands that are more strongly marked; in other words, a trail of glands seems here to go between the seventh and the eighth setigerous segments. Further, there are on the eighth setigerous segment a number of glands in a triangle behind the parapodia, in the same way as in the seventh setigerous segment, and at least the ninth and tenth setigerous segments, whilst further back this group diminishes more and more. In addition, there are on the posterior part of the segment in the larger individuals, a number of delicate dispersed glands, as is also the case on the following segment. The glands of the ventral nerve-cord, which proceed over the glandular band in front of the parapodia, are slightly interrupted immediately behind the same band, but afterwards continue posteriorly. On the following segment these glands form narrow but powerful bands along the ventral nerve-cord; they diminish abruptly in the fifteenth setigerous segment, and shortly afterwards disappear altogether. From the ninth to the seventeenth setigerous segment at least there is a spot without glands on the ventral nerve-cord immediately in front of the uncini. In the larger individuals, moreover, there is to be seen, on the eighth to the twelfth (or thirteenth?) setigerous segment, a fine glandular streak running between the somewhat extended upper point of the collection of glands behind the parapodia and the next parapodia behind. The glands in front of and behind the parapodia join over the capillary setae on either side; and these glands further join by means of bridges transversely over the dorsal from the fourteenth or the fifteenth setigerous segment; these bridges increase backwards as far as the eighteenth setigerous segment, inclusive, and thereafter diminish; but they are nevertheless still visible on the three achaetous segments (figs. 8 and 9). Then follow fairly strong glands on the callus-shaped ring, and also on the outside of the cup-shaped section (with the exception of the posterior under part), and of the large cirri. In the larger

individuals there can be seen a strongly marked glandular ring near the edge of the cup-shaped section; the inside thereof, like the inside of the cirri, lacks glands.

Setae.—The following notes on the setae are, for the most part, based on the two largest individuals.

The uncini on the first to the third setigerous segments are usually single in each parapodium. In some individuals, however, two uncini have been observed on one side of the third setigerous segment. These uncini are very strongly transformed; they have the great tooth, especially on the first setigerous segment, only slightly bent, lack bristles, and possess a highly thickened proximal portion (figs. 20-21). The number of the teeth is 3¹, 4²⁻³. Under the great tooth there is on the very first setigerous segment a distinct little boss, corresponding to the attachment for the bristles in the developed uncini; like the bent form of the great tooth, the boss increases on the two following segments.

So early as on the fourth setigerous segment there are fully developed uncini, all with bristles; the topmost uncini of the segment, on the other hand, have the great tooth rather blunt-headed (fig. 22). Moreover the uncini on the more anterior of these segments are more faintly developed in their outer part; posteriorly, they acquire an outer part which is greatly extended, and in comparison with the inner portion considerable. The attachment of the bristles forms against the base of the great tooth a little circle which is extremely characteristic in shape (fig. 25). The number of the uncini on setigerous segments 4-19 of the large complete individual is: 9, 9, 10, 11, 12, 12, 14, 14, 14, 14, 13, 11, 10, 10, 6, 5—the last two segments not being completely regenerated. Number of teeth is 5⁴⁻⁵, 6⁶⁻¹³, 5-6¹⁴⁻¹⁹. One individual, whose anterior region, as far as the eighth setigerous segment inclusive, attains a length of 10·5 mm, possesses on these segments the following number of uncini: 1, 1, 1, 7, 7, 7, 8, 9.

The anterior capillary setae have faint borders which towards the hinder parts of the body almost disappear. The point of these setae is long; from the tenth setigerous segment onwards the point bears a very distinct pencil of bristles (fig. 26), which is broadest (c. 14 μ) near the base, where it does not always finish off simultaneously on both sides. On the seventh setigerous segment the pencil of bristles is rather faint, and further forward it disappears all but completely; but nevertheless traces of it have been observed on the third and on the second setigerous segments. On the eighth and ninth setigerous segments this pencil of bristles is excessively fine, extended, and of even breadth; its breadth in the case of large individuals is only about 4 μ . At the same time the number of anterior capillary setae on these two segments is

very considerably increased, and these capillary setae are in every respect very fine.

The posterior capillary setae possess comparatively short points on the first three setigerous segments; the borders—both of the two or only one—are here pretty broad (fig. 23). Towards the hind part of the body the borders diminish gradually; but one is always broader than the other, and even on the hindmost segments of no inconsiderable breadth. The points themselves increase in length backwards, to begin with; nevertheless the narrow extreme point on a number of the bristles is comparatively short, since the point at the base is, so to speak, somewhat enlarged. These broadened points begin on the sixth setigerous segment, after which they are distinct in the seventh to the ninth setigerous segments. On the next segment no such points have been observed; but on the eleventh and on the twelfth setigerous segments they again begin to assume this form, which is most strongly developed on the next segment (fig. 24). On the fourteenth setigerous segment these broadened points diminish; and, from the fifteenth setigerous segment onwards, many of the upper setae seem to lack them altogether.

It would seem as if the posterior setae on the eighth and the ninth setigerous segments—that is to say, where the anterior capillary setae are especially fine and numerous—are not so numerous as on the other segments. The material at my disposal, however, has not permitted a definite settlement of this question.

Size.—The two largest individuals investigated by me were taken in Blacksod Bay, Station W. 115; the one which is complete, and which has been preserved within its tube, measures 85 mm. in length; its posterior region, however, in particular, is drawn together, not to say folded up. Its greatest breadth is 1.2 mm. The forward end of the second large individual measures, up to its twelfth setigerous segment, 48 mm. in length; this individual is somewhat larger than the former.

Sexual Maturity.—The two individuals just mentioned, which are both ♀ ♀ and which were taken on 16 September, 1909, are fairly full of eggs which are still of different sizes; in the first ♀ the largest eggs attain a magnitude of 0.22×0.28 mm.

Tubes.—The tubes are rather thin and brittle, and seem in all localities to be composed, besides the inner light-coloured membrane, of a layer of fine grains of sand, chiefly light in colour. That one of the two largest individuals just named, which is complete, possesses a tube whose external diameter is 1.7 mm. For further particulars about the tubes see "Information about Earlier Finds."

Notices of Finds.—The individuals before me are all from the West Coast of Ireland:—

Elly Bay, Blacksod Bay, Station W. 115, 16/9 (10, p. 170): seven individuals.

Elly Bay (N. Shore), Blacksod Bay, Station W. 119 (10, p. 170): five individuals.

From one of the following stations:—L. 296–L. 300 (6, p. 41): one individual.

S.W. of second buoy of Margaretta Shoal (Galway Bay), Station A. 124 (7, p. 94), 18 m.: two individuals.

Information about Earlier Finds.—Cunningham and Ramage (1, p. 679) procured this species in the Firth of Forth. They write as follows about it:—“Got in great numbers inhabiting fine tubes buried in the sand, with only their upper ends protruding. The tubes often have a branch in the lower part of their course, and extend down to a depth of six or eight inches. The upper end is quite plain and open. The worms lie in their tubes with either their head or their tail uppermost indifferently, so that they can evidently turn in them. The locality whence our specimens were got was the flat sands for two or three hundred yards to the west of the Birnie Rocks, where the upper ends of the tubes form a sort of miniature forest all over the surface. Length three or four inches when fully extended, but when contracted, it is much less.”

Hornell (2, p. 155) knows the same species as Cunningham and Ramage’s “*Axiothea catenata*” from Liverpool Bay, where it occurs extremely commonly. The fact that he has observed the seven longer anal cirri shows that he refers to *Cacsivirrus neglectus*. When he reports the existence of four posterior achaetous segments, he is obviously counting in the posterior callus-formed ring.

Regeneration.—Elly Bay: 1 individual: 7 anterior segments; 1 individual: 2 and 1 individual: 11 posterior setigerous segments. Station A. 124: 2 individuals: 11 posterior setigerous segments.

***Heteroclymene robusta* Arwidsson.**

From the West Coast of Ireland—more precisely Station L. 245 (6, p. 38) or Fahy Bay, Channel and Bar, 1·8–5·5 m.—comes a small individual which is complete, and which, like the first and hitherto only known complete individual (5, p. 227), possesses nineteen setigerous and five posterior achaetous segments. The anterior region is regenerated as far as the first setigerous segment inclusive, and the posterior region from the ninth setigerous segment inclusive. The length of the second to the eighth setigerous segments, which are normally developed, is 9·5 mm.

The species is hitherto only known from the warmer parts of the west coast of Norway, where it attains a considerable size. It very easily breaks to pieces, however, in dredging—a process which in Norway usually only gives you the hindmost part, easily recognizable, however. The complete individual previously known was also very small.

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DESCRIPTION OF PLATES XVII.-XIX.

The specimen of *Caesicirrus neglectus* used for figs. 1, 2, 5-7, are from Station A. 124; for figs. 3, 4, 12, from Station W. 115; and for figs. 8-10 from Station W. 119. The material of *Nicomache maculata* that has supplied the basis for the figures dealing therewith is from Stella Maris Bay, Howth.

The ciphers standing to the left of the figures give the numbers of the setigerous segments; the ciphers to the right give the magnification.

"Glands" indicates that the epidermal glands, coloured with iodine green, are given in the figures referred to.

PLATE XVII.

Caesicirrus neglectus n. sp.

Fig.

1. Anterior region seen from beneath. Glands. 27 : 1.
2. Anterior region. Glands; the same individual as the preceding. 16 : 1.
3. Setigerous segments 7-10, seen from beneath. Glands. 9 : 1.
4. Section in front of the first setigerous segment, from beneath, with ocelli 20 : 1.
5. Anterior region seen from above. Glands. Same individual as fig. 1. 27 : 1.
6. Setigerous segments 7-8, seen obliquely from above. Glands. Same individual as fig. 1. 22 : 1.
7. Head from the side; sketch without colour. Same individual as the foregoing. 27 : 1.
8. Posterior region seen from the left side. Glands. 27 : 1.
9. The same section as in the preceding figure, seen from above. Glands. 24 : 1.

PLATE XVIII.

Caesicirrus neglectus n. sp.

Fig.

10. Rear end seen from behind; same individual as preceding figure. 27 : 1.
11. Detail of the preceding figure. 83 : 1.
12. Rear end with anal opening turned inside out, seen from behind. 27 : 1.

Nicomache (*Nicomache*) *maculata* n. sp.

13. Head, seen from the front. Natural colour. 14 : 1.
14. Anterior region from the right side. Natural colour. 10 : 1.
15. Anterior region as far as the third setigerous segment inclusive, seen from the left side. Natural colour. 15 : 1.
16. Posterior region from the twentieth setigerous segment inclusive, seen from the left side; the hindmost segment, which is usually achaetous, here has capillary setae. Glands. 12 : 1.
17. Section in front of the first setigerous segment, seen from the right side. Glands. Natural colour exclusively. 16 : 1.
18. Rear end seen from behind. Glands. + indicates the position of the ventral nerve-cord. 16 : 1.
19. Anterior region as far as the eighth setigerous segment inclusive, seen from beneath. Glands. 10 : 1.

PLATE XIX.

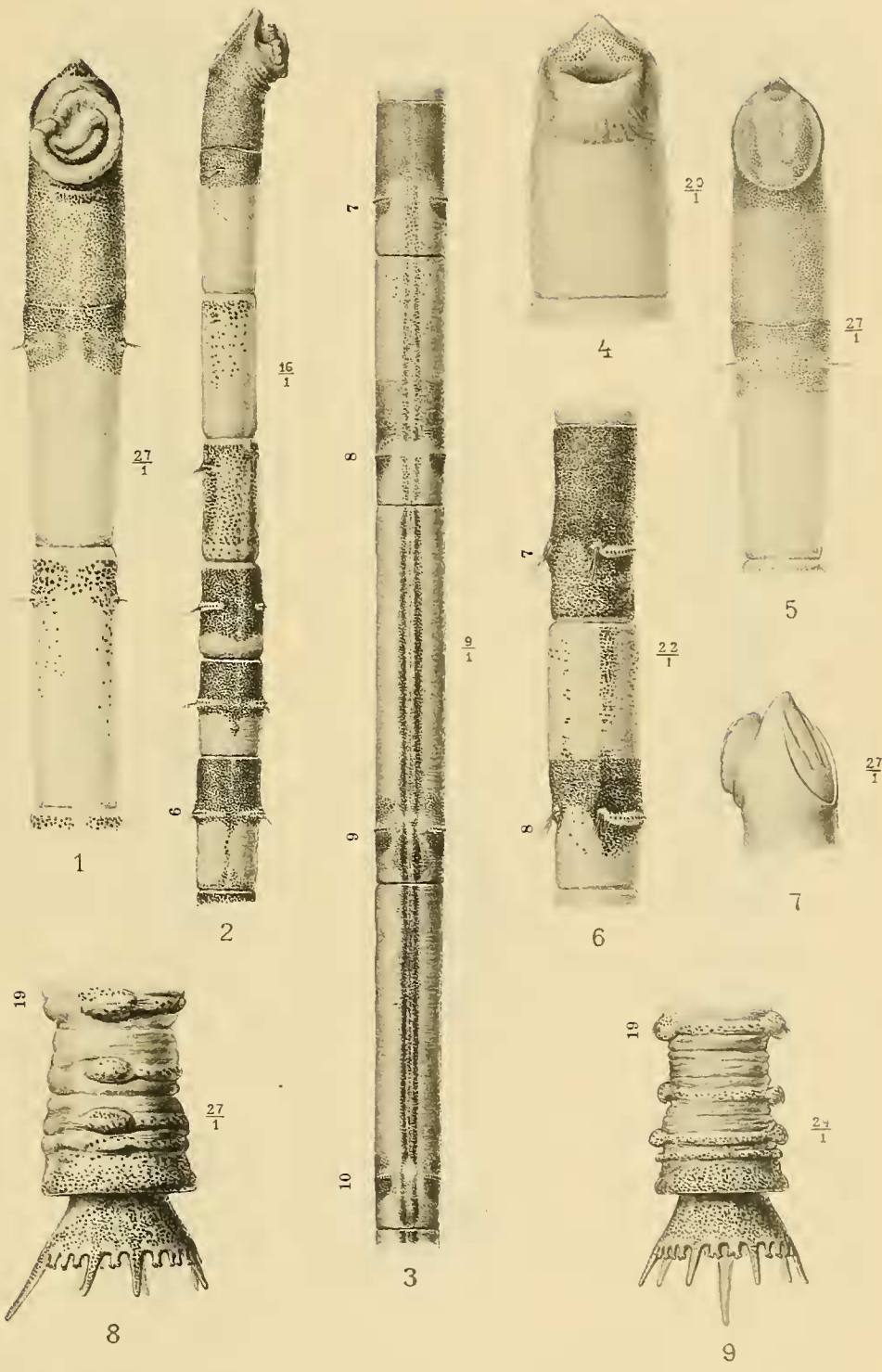
Caesicirrus neglectus n. sp.

Fig.

20. Uncinus from the first setigerous segment. 500 : 1.
21. Uncinus from the third setigerous segment. 390 : 1.
22. Uncinus (second from above) from the fourth setigerous segment. 440 : 1.
23. Posterior capillary seta from the third setigerous segment. 440 : 1.
24. Point of the posterior capillary seta from the thirteenth setigerous segment. 500 : 1.
25. Uncinus (thirteenth from above) from the tenth setigerous segment. 530 : 1.
26. Anterior capillary seta from the seventeenth setigerous segment. 670 : 1.

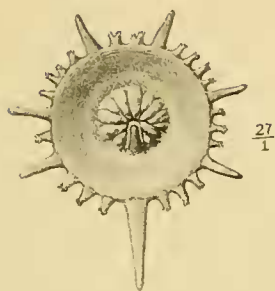
Nicomache (Nicomache) maculata n. sp.

27. Spine from the second setigerous segment. 85 : 1.
28. Uncinus (fourth from above) from the fourth setigerous segment. 390 : 1.
29. Uncinus (eighth from above) from the eleventh setigerous segment. 415 : 1.
30. Posterior capillary seta from the eleventh setigerous segment. 350 : 1.

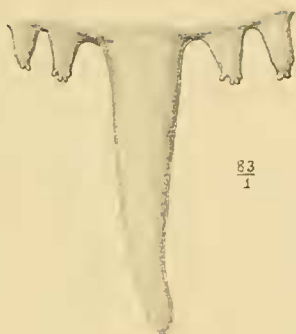


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Cederquists Graf. A.-B., Sthlm.



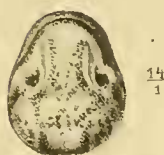
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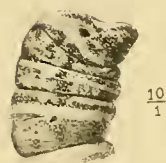
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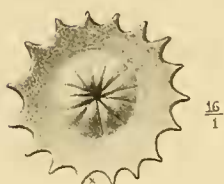
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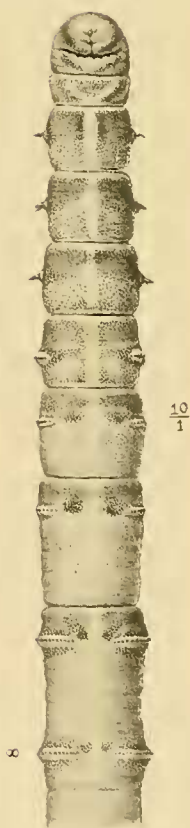
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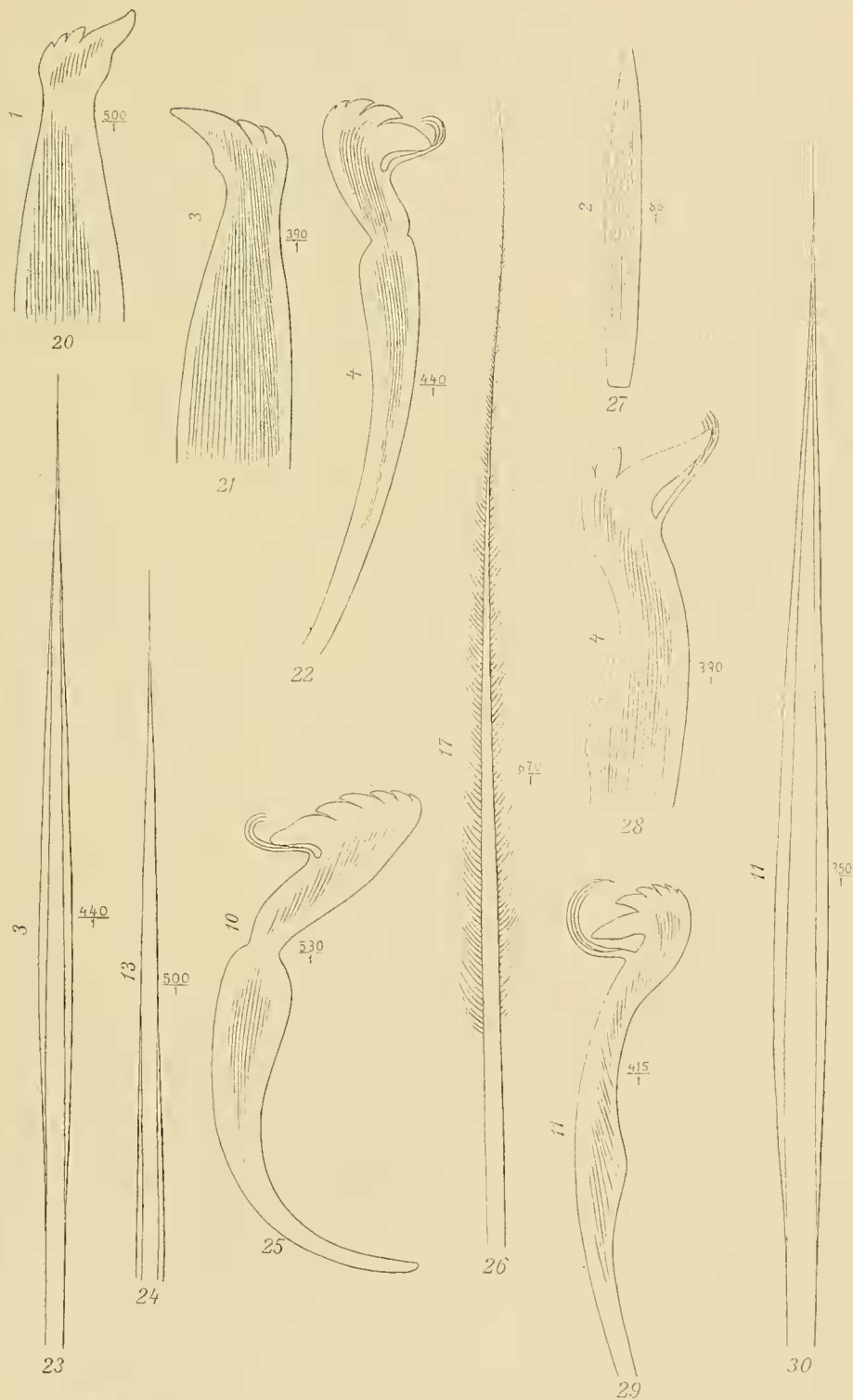
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B. Wissler del.

Cederquists Graf. A.-B., Sthlm.

VII.

REPORT ON THE "DINGLE BED" ROCKS IN THE DINGLE
PENINSULA, CO. KERRY.

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PLATES XX, XXI.

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THE question as to the true geological horizon of the "Dingle Beds" in the Dingle peninsula, is one that has engaged the attention of many geologists for over fifty years, and, so far, without any definite opinion having been arrived at.

Amongst those who have dealt with these rocks were Sir R. Griffith, Professor Jukes, Professor Hull, John Kelly, A. B. Wynne, G. V. Du Noyer, G. H. Kinahan, and the Geological Survey of Ireland generally. It will be seen from the papers of the writers mentioned, and the publications of the Geological Survey, that all considered the "Dingle Beds" to be either the highest beds of the Upper Silurian, or portion of the Devonian or Lower Old Red Sandstone formations.

Sir R. Griffith regarded the beds as belonging to the Silurian system, but did not state their position in the series.¹ Professor Jukes, in his various papers, considered the "Dingle Beds" to be connected with the Upper Silurians; and in the Geological Survey maps, published under his direction, they are provisionally placed above the fossiliferous Ludlow rocks.² Professor Hull regards the "Dingle Beds" as being above the Ludlow rocks, and the highest portion of the Upper Silurian series.³ John Kelly, in his paper on the "Greywacke Rocks of Ireland," gives an account of the "Dingle Beds," and puts them among the Upper Silurians; but he did not state in which particular division he would locate them.⁴ The late G. H. Kinahan, M.R.I.A., in his paper read at a Scientific Meeting of the Royal Dublin Society,

¹ Journal Geol. Soc. of Dublin, vol. ii, p. 28 (1843); vol. viii, p. 2 (1858).

² Journal Royal Geol. Soc. of Ireland, vol. i, p. 105 (1867).

³ Quarterly Journal Geol. Soc., vol. xxxv, pp. 669-723 (1879).

⁴ Journal Geol. Soc. of Dublin, vol. vii, pp. 276-290 (1860).

May 18th, 1885, refers the "Dingle Beds" to the Lower Old Red Sandstone and Lower Devonian, the "Smerwick Beds" to the May Hill Sandstone (Llandovery) or "passage-beds" between the Ordovician and Silurian (Upper Silurian), and the "Annascaul Beds" to the Caradoc-Bala group. Professor Reynolds and Mr. Gardiner, in their very exhaustive paper on the fossiliferous Silurian beds of Clogher Head, Dingle district, do not deal particularly with the "Dingle Beds." They merely allude to them, and leave them in the position provisionally assigned to them by the Geological Survey, as probably belonging to the Lower Devonian. They, however, say that the "Smerwick Beds" "are undoubtedly the oldest beds in this area, and that they are probably of Llandovery age, as they are conformably overlain by the fossiliferous Wenlock Rocks,"¹ and with this I quite agree.

Having had some opportunity of studying these rocks while I was attached to the Geological Survey of Ireland, and recently, with the aid of a grant from the Royal Irish Academy, of making further investigations in the Dingle peninsula of the so-called "Dingle Beds," and the rocks adjoining them, I have arrived at the conclusion that, with the "Smerwick Beds," they form the lowest portion of the Upper Silurian Series in this area, and that they are probably of Llandovery age; and, furthermore, that they rest unconformably on the Lower Silurian (Ordovician) rocks, provisionally called "Annascaul Beds" on the Survey map, and that their seeming conformable overlapping on the fossiliferous Wenlock and Ludlow Beds of West Dingle, on the south, is due to inversion and overthrusting of the strata from the south, as is shown on the accompanying diagrammatic section.

Fossiliferous Wenlock and Ludlow rocks of West Dingle at Ferriter's Cove, Clogher, and Dunquin, have been fully described in the Geological Survey memoirs on the district in 1863, and later, by Professor Reynolds and Mr. Gardiner, as already mentioned. Extensive lists of fossils are given in those publications, which fully prove the geological horizons of the Wenlock and Ludlow Rocks.

A series of rocks to the north of Ferriter's Cove Wenlock beds are admittedly in their normal position, underlying the Wenlock beds in regular order. These are shown on the Geological Survey map as "Smerwick Beds," and separated from the "Dingle Beds" in the peninsula. Having recently examined those "Smerwick Beds," I have no doubt that they belong to the "Dingle Bed" series, and should not have been separated from them, as they are identical with them in every respect. Du Noyer noted on his field-map, when surveying the district over fifty years ago, with regard to the "Smerwick

¹ Quarterly Journal Geol. Soc., vol. lviii, pp. 226-266 (1902).

Beds" at Sybil Head, that they are "quite the same in mineral aspect as those forming Black Head, south of Dingle," which form the "Parkmore Conglomerate" zone of the "Dingle Beds."

All round the areas of Wenlock and Ludlow Beds on the north, and north-west, the "Dingle Beds" occur rising from beneath them. But on the south margin they appear to overlies the Ludlow and Wenlock strata. This is due, I hold, to inversion of the strata, as suggested in the accompanying section.

So far no direct fossil evidence has been forthcoming to prove the possible Llandovery age of the "Dingle Beds"; but it is an important fact that in the conglomeratic beds, towards the lower portions of the "Dingle Beds," rolled pebbles of fossiliferous Lower Silurian limestone and grit are found in considerable abundance, in what has been named, by the Geological Survey, "Parkmore Conglomerate." Those limestone pebbles have undoubtedly been derived from the Annascaul rocks lying to the south along their margin, and on the north from similar rocks now overlapped and concealed by Old Red Sandstone, as shown on the diagrammatic section: and they were deposited amongst the overlying and succeeding "Dingle Beds" (probably Llandovery) during their deposition on the eroded and worn-down surface of the Lower Silurian rocks. (See Survey memoir, pp. 16, 17, 33.) The limestone, which belongs to the "Annascaul Beds," is to be seen *in situ* at a couple of places high up on the western slope of Caherconree mountain. It is identical in its characters with the Lower Silurian limestones of Portraine and Lambay, County Dublin, the Chair of Kildare, County Kildare, and Tourmakeady, County Mayo, and contains similar fossils, a list of which is given in the Survey Memoir, p. 12. The occurrence of the Trilobite *Acidaspis Jamesii* and other Silurian forms in this limestone is alluded to by Professor Jukes, as "seeming to indicate that the rocks belonged to the Bala group, a part of the Lower Silurian series" (Survey Memoir, p. 12). Specimens of this fossiliferous limestone, and of the fossiliferous limestone pebbles out of the "Parkmore Conglomerate" of the "Dingle Beds" are in the Geological Survey Collection, in the National Museum.

The belt of rocks ranging from Minard Bay, by Annascaul to Caherconree mountain, have been provisionally designated "Annascaul Beds (Bala or Llandovery rocks)" on the Geological Survey map. From their close resemblance to the Bala limestone and black graptolitic shales and other rocks of Ordovician types in Counties Dublin, Kildare, and Mayo, I have no doubt they are of similar age, *i.e.*, Lower Silurian. When this region was being surveyed over fifty years ago, and subsequently re-examined in 1878, the great importance and effects of inversion and overthrusting were not realized to their full extent. Had it been, I have no doubt the true geological reading

of the district would have been understood. Indeed Du Noyer saw that there was inversion of the strata on the south, as his notes on the field-map show and he alludes to it in the Memoir, pp. 18, 22, 38.

A great number of pre-Old Red Sandstone faults and overthrusts exist in the Dingle district. The boundary between the "Dingle Beds" and "Annascaul Beds" lying to the south of them, is evidently an overthrust fault that extends the whole way, and probably along, or close to, the original zone of unconformability between the two series of rocks. Du Noyer notes that this line is either a fault or an unconformability, and that the "Dingle Beds" are inverted close to their junction with the Annascaul rocks.¹

As already stated, I consider the line to be an overthrust fault-boundary along or near the zone of unconformability. The junction zone shows evidence of great crushing and movement wherever the two sets of rocks come in contact or close together, as north of Annascaul, at Bull's Head, and at Minard Bay, and elsewhere along the line of junction.

As already mentioned, the conglomerates of the "Dingle Beds" to the north, at the Smerwick Harbour, being so exactly like those of Parkmore Point, and containing similar derived pebbles of fossiliferous limestone and grit, points to their being in their proper position, towards the base of the series. Du Noyer mentions this in the Survey Memoir, pp. 20, 29. It will be seen in the diagrammatic section how the conglomerates with derived pebbles come in both on the north and south of the fossiliferous Wenlock and Ludlow beds. Many minor folds and faults are proved amongst the Wenlock and Ludlow rocks, striking generally east and west, as well as others ranging northwards. The line of boundary between the fossiliferous Silurians and the "Dingle Beds," a little south of Dunquin, on the west, is a fault or overthrust.

On the coast to the east of Clogher Head, a small area of Old Red Sandstone, resting unconformably on the Ludlow Beds, has been faulted down amongst the Ludlow rocks. This Old Red Sandstone has been noticed by Professor Reynolds and Mr. Gardiner, who also allude to the abundant evidence of overthrusting and overfolding throughout the Silurian inlier. Du Noyer alludes to this Old Red Sandstone in the Survey Memoir, p. 22, but refers to it as being a "portion of the Dingle Beds, resting unconformably on the Ludlow rocks." I agree with Professor Reynolds and Mr. Gardiner, that it belongs to the Old Red Sandstone formation, faulted into its present position.

Folding and contortion have also occurred amongst the "Dingle Beds" as well as in the Silurians above them. A well-defined synclinal fold is noticeable along the coast from near Sleah Head to Ventry Harbour, and was traced

¹ Geol. Survey Memoir to sheets 160, 161, 171, and 172, p. 33 (1863).